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**United States Patent** [19]

Gudesen et al.

[11] **Patent Number:** **6,005,791**[45] **Date of Patent:** **Dec. 21, 1999**[54] **OPTICAL LOGIC ELEMENT AND OPTICAL LOGIC DEVICE**

[76] Inventors: **Hans Gude Gudesen**, Tyrihansveien 5, N-1639 Gamle Fredrikstad; **Per-Erik Nordal**, Hestehagen 19, N-1360 Nesbru; **Geirr I. Leistad**, Jongsstubbøen 19, N-1300 Sandvika, all of Norway

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[51] **Int. Cl.<sup>6</sup>** ..... **G11C 13/04**[52] **U.S. Cl.** ..... **365/114; 365/215**[58] **Field of Search** ..... 365/114, 115,  
365/169, 170, 215[56] **References Cited****U.S. PATENT DOCUMENTS**

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*Primary Examiner*—Tan T. Nguyen[57] **ABSTRACT**

Addressable optical logic elements contain an optical memory substance, wherein, under the influence of an impressed magnetic, electromagnetic or electrical field or supplied energy, the memory substance can transfer from one physical or chemical state to a second physical or chemical state, wherein a physical or chemical state is assigned a specific logic value, and wherein a change in the logic element's physical or chemical state causes a change in the logic value and is implemented by the logic element being accessed and addressed magnetically, electromagnetically, electrically or optically for writing, reading, storing, erasing and switching of an assigned logic value.

The optical logic device is especially usable for storing data or performing logic and arithmetic operations, wherein the device includes a plurality of optical logic elements, wherein the optical logic elements particularly are multistate, multistable optical logic elements, and even more particularly proximity-addressable optical logic elements, including an optical memory substance, wherein, under the influence of an impressed magnetic, electromagnetic or electrical field or supplied energy, the memory substance can transfer from one physical or chemical state to a second physical or chemical state, wherein a physical or chemical state is assigned a specific logic value, and wherein a change in the logic element's physical or chemical state causes a change in the logic value and is implemented by the logic element being accessed and addressed magnetically, electromagnetically, electrically or optically for writing, reading, storing, erasing and switching of an assigned logic value.

**52 Claims, 10 Drawing Sheets**